FCC 96-155

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
	)	
The Development of Operational,	)	WT Docket No. 96-86
Technical, and Spectrum	)	
Requirements for Meeting	)	
Federal, State and Local Public	)	
Safety Agency Communication	)	
Requirements Through the	)	
Year 2010	)	

NOTICE OF PROPOSED RULE MAKING

Adopted: April 5, 1996 **Released: April 10, 1996**

Comments Due: **September 20, 1996**
Reply Comments Due: **October 18, 1996**

By the Commission: Commissioner Chong issuing a statement.

TABLE OF CONTENTS

Paragraph

I. INTRODUCTION

1. In this proceeding, the Commission seeks to address the present deficiencies in public safety wireless communications as well as its expanding spectrum needs. These deficiencies include lack of interoperability, minimal access to emerging technologies, limited service feature options, less than optimal transmission and reception quality, and scarce available spectrum. This *Notice of Proposed Rule Making* (*Notice*) proposes measures designed not only to address these deficiencies but also to accommodate the future communications needs of public safety agencies. We believe that the critical responsibilities of the nation's public safety agencies require modern and innovative communications at high levels of efficiency and effectiveness. This *Notice* describes the history of public safety communications and provides an overview of specific wireless communications deficiencies identified by the Commission in consultation with public safety agencies.

2. The *Notice* also furthers the Commission's efforts to implement Section 6002 of the Omnibus Budget Reconciliation Act of 1993,[1] which requires the Commission to study public safety spectrum needs and to develop a plan that ensures that adequate frequencies are available for public safety uses through the year 2010.[2] In early 1995, the Commission adopted a Report and Plan concerning the current and future spectrum needs of state and local

[1] Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, Title VI, § 6002, 107 Stat. 312 (codified 47 C.F.R. § 309(j)(10)(B)(iv)) (Budget Act).

[2] *Id.*

government public safety agencies through the year 2010 and how to ensure that adequate frequencies are made available to public safety licensees.[3] In the *1995 FCC Public Safety Report*, we concluded that more information from public safety agencies and other interested parties was necessary to define, with any precision, the scope of the public safety community's spectrum needs. In this connection, the Commission and the National Telecommunications and Information Administration (NTIA) established the Public Safety Wireless Advisory Committee (PSWAC) to provide advice and recommendations on the various requirements of public safety agencies through the year 2010. PSWAC has five subcommittees -- Operational Requirements, Technology, Interoperability, Spectrum, and Transition. This *Notice* tracks PSWAC's organizational structure. In addition, we are initiating this proceeding to develop the data necessary to evaluate the spectrum needs of public safety agencies, to solicit comment on how best to meet these needs, and to propose measures aimed at facilitating the transition to an environment where public safety agencies have communications services of higher quality, access to emerging technologies, and availability of broader service offerings.

II. EXECUTIVE SUMMARY

3. By this action, the Commission initiates an overall evaluation and assessment of public safety wireless communications, which builds upon our findings and conclusions presented in the *1995 FCC Public Safety Report*. We believe that the critical responsibilities of public safety agencies, such as protection of life and property, can be performed more effectively by increasing the flexibility and opportunities that wireless communications can offer. The goal of this proceeding is to develop the data necessary to evaluate the spectrum needs of public safety agencies, to solicit comment on how best to meet these needs, and to facilitate a transition to a communications environment in which public safety agencies have access to higher quality transmission, emerging technologies, and broader services, including the ability to communicate readily with one another (interoperability). We recognize that such an environment can be achieved through a variety of regulatory approaches, such as requiring more efficient use of current public safety spectrum, reallocating additional spectrum for public safety uses, and facilitating the use of commercial service providers for increased communications capacity. We believe, however, that no one approach will satisfy all public safety communications spectrum needs. We further believe that the optimal approach should allow each of these individual approaches to be strategically combined in a way that meets the specific needs of individual public safety entities.

4. As part of the Commission's evaluation of the current and future spectrum needs of public safety agencies, this *Notice* seeks comment on: (1) regulatory approaches that will facilitate the development of interoperable equipment and technologies; (2) the service features and system requirements essential to the effective performance of public safety

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[3] Report and Plan for Meeting State and Local Government Public Safety Agency Spectrum Needs Through the Year 2010, *Report and Plan*, FCC No. 95-55, adopted Feb. 9, 1995, released Feb. 9, 1995 (*1995 FCC Public Safety Report*).

functions; (3) technological issues regarding the enhancement and improvement of public safety wireless communications; (4) means of allocating spectrum for public safety agencies to ensure that they have adequate spectrum to perform their duties; (5) the measures that need to be implemented in order to foster an environment which promotes public safety wireless communications which are spectrally-efficient, of high quality, and effective; and (6) the means to promote competition in the supply of goods and services used by public safety agencies.

III. BACKGROUND

A. Overview and History of Public Safety Communications

5. Under the Communications Act of 1934, as amended, the Commission has authority to allocate and assign frequencies for use by entities other than the Federal Government. In 1937, with the creation of the Police Radio Service, the Commission began allocating spectrum to agencies charged with protecting the public welfare. As the communications needs of other public safety agencies surfaced, the Commission allocated additional spectrum to them. As a result of this approach to public safety spectrum allocation and administration, the Public Safety Radio Services (PSRS) developed into a collection of services used by various public safety agencies which have placed a priority on the use of radio communications in the fulfillment of their respective missions. Specifically, the PSRS consists of the Police, Fire, Highway Maintenance, Forestry-Conservation, Local Government, and Emergency Medical Radio Services.[4] The Special Emergency Radio Service (SERS) also is utilized by public safety agencies.[5] Each of these services is discussed separately below.

6. *Police Radio Service*. This service governs the radio communications associated with police operations (*e.g.*, dispatching vehicular units and coordinating tactical operations) and administrative matters (*e.g.*, deployment of patrols and status of units).[6] Eligibility in this service is limited to any non-Federal governmental entity or institution authorized by law to provide its own police protection, including state police, county sheriffs, and local police departments.

7. *Fire Radio Service*. This service governs the radio communications associated with fire protection activities and related administrative functions. In addition, where a fire department has responsibility for providing rescue and ambulatory functions, the frequencies allocated to this service can be used for dispatching ambulances, communicating medical

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[4] The public safety services are licensed under Subpart B of Part 90 of the Commission's rules, 47 C.F.R. Part 90, Subpart B.

[5] The Special Emergency Radio Service is licensed under Subpart C of Part 90 of the Commission's rules, 47 C.F.R. Part 90, Subpart C.

[6] *See* 47 C.F.R. § 90.19.

information to personnel at the site of an emergency, and transmitting biomedical telemetry from the emergency site or the ambulance to hospital emergency room personnel. Any non-Federal governmental entity (typically a firefighting organization) is eligible for this service with the permission of the local government having jurisdiction over the area to be served.[7]

8. *Highway Maintenance Radio Service.* This service governs the radio communications related to the highway activities of any non-Federal government entity requiring communications essential to its official highway activities. Licensees of this service use mobile communications in performing a wide range of functions, including road maintenance and paving operations, ice and snow removal, removal of disabled vehicles, patrol of tunnels, bridges, and turnpikes, and recall or reroute of highway crews and vehicles to meet changing priorities due to highway and weather emergencies.[8] Any non-Federal governmental entity with official highway activities is eligible in this service.

9. *Forestry-Conservation Service.* This service governs radio communications for law enforcement (*e.g.*, park police and rangers who enforce fish, game, and environmental statutes), fire prevention control, and emergency medical service in connection with forestry-conservation activities.[9] Licensees in this service provide fire detection and control for one-half billion acres of non-Federal forest lands. Any non-Federal governmental entity is eligible in this service, including persons or organizations charged with specific forestry-conservation activities with the support of the local government having jurisdiction over the area to be served.

10. *Local Government Radio Service.* This service governs the radio communications involving the day-to-day operations of governmental entities other than the Federal Government.[10] Entities eligible to operate in this service include states, U.S. territories and possessions, counties, cities, towns, and many other types of specialized governmental districts and authorities (*e.g.*, flood control, water, sanitation) for a variety of public safety and welfare uses. In addition, all public safety entities are permitted to use frequencies allocated to this service and often include law enforcement, fire protection, highway maintenance, lifeguard and rescue service users.

11. *Emergency Medical Radio Service.* This service governs the radio communications for the actual emergency treatment including (1) transmission between rescuers at the scene of an accident or disaster and physicians at a hospital; and (2) the dispatch of emergency medical providers transporting injured persons to hospitals and trauma

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[7] *See* 47 C.F.R. § 90.21.

[8] *See* 47 C.F.R. § 90.23.

[9] *See* 47 C.F.R. § 90.25.

[10] *See* 47 C.F.R. § 90.17.

centers.[11] Eligibility for this service is limited to persons or entities engaged in the provision of basic or advanced life-support services on an ongoing basis.

12. *Special Emergency Radio Service*. This service governs radio communications related to medical services, rescue organizations, disabled persons, veterinarians, disaster relief organizations, school buses, beach patrols, communications standby facilities, and emergency repair of public communications facilities. Entities not meeting these eligibility criteria may be licensed in this service solely to provide service to SERS eligibles on one-way paging-only frequencies below 800 MHz.[12]

13. The Commission has allocated spectrum for use by entities licensed in these services in five different frequency bands. Public safety mobile service operations traditionally have consisted of two-way communications between a base and mobile station or between two mobile stations. The Commission's early public safety spectrum allocation was primarily confined to the 30-50 MHz bands in an effort to accommodate two-way communications.

14. As public safety agencies' communications needs increased, these frequencies became increasingly congested. As a result of technological advances such as the continuing advance of solid state electronics with its attendant increasing miniaturization and precision, public safety equipment became capable of transmitting at higher frequencies and, thus, other spectrum could be used for two-way communications. This opportunity for public safety agencies to migrate to higher frequencies provided temporary and limited relief for public safety licensees needing additional spectrum. These higher frequencies, however, generally do not possess the long distance capability of lower frequencies. Thus, migration has not been a viable option for those public safety agencies operating in rural areas. Migration also has been problematic for public safety licensees in urban and suburban areas because the additional frequencies often are simply added to the licensees' existing systems. As a result, a public safety licensee's system may need to be fragmented after migration because it utilizes both high and low band frequencies and communications between frequencies are, as a practical matter, precluded. For example, several public safety agencies must use two or more frequency bands for their systems, which requires individual users to carry multiple transceivers in order to communicate on and interact with the systems.[13] In addition, the varying development rates of transmission technology for different frequency bands have contributed to the fragmented allocation of public safety spectrum. The result is a series of allocations that make it difficult for different agencies to communicate across jurisdiction or for different agencies in the same jurisdiction to communicate.

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[11] *See* 47 C.F.R. § 90.27.

[12] *See* 47 C.F.R. §§ 90.33 and 90.53(b)(4) or (26).

[13] *See Order*, PR Docket No. 84-232, FCC 85-329, 50 Fed. Reg. 32239 (1985).

15. The current spectrum allocated to public safety services consists of 941 channels as indicated in the following chart:

CURRENTLY ALLOCATED PUBLIC SAFETY RADIO SPECTRUM		
Frequency Band (MHz)	**Number of Channels**	**MHz (Approximate)**
25-50 (VHF high band)	**315**	**6.3**
150-174 (VHF high band)	**242**	**3.6**
220-222 (220 band)	**10**	**0.1**
450-470 (UHF band)	**74**	**3.7**
806-821/851-866 (800 bands)	**70**	**3.5**
821-824/866-869 (800 public safety bands)	**230**	**6**
TOTAL	**941**	**23.2**

Public safety agencies also are eligible to operate on other shared frequencies. For example, various frequencies from 2 to 25 MHz are available for disaster communications.[14] Public safety agencies are eligible for licensing in the Private Operational-Fixed Microwave Service.[15]

16. In an era characterized by progress, innovation and choice in the telecommunications industry, the communications capability of the nation's public safety agencies remains severely challenged. Moreover, there is limited competition among equipment and service providers of public safety communications. These challenges cause public safety communications to be far more cumbersome than necessary, which ultimately results in potential compromise to the critical operations performed by public safety agencies.

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[14] *See* 47 C.F.R. §§ 90.263 and 90.264.

[15] Microwave spectrum in the bands above 1000 MHz also is available for public safety communications. *See* 47 C.F.R. § 94.5.

B. Recent Legislative and Regulatory Developments

17. Since 1980, the Commission has initiated over 40 general and service-specific proceedings seeking to promote the efficiency, effectiveness, and enhancement of public safety communications.[16] Moreover, in 1987, the Commission chartered the National Public Safety Planning Advisory Committee.[17] Subsequently, the Commission took additional action to develop a National Plan, pursuant to the recommendations of the National Public Safety Planning Advisory Committee, to govern the use of six megahertz allocated to the PSRS in the 800 MHz band (821-824/866-869 MHz) on a regional basis throughout the United States.[18] Recently, Senator Larry Pressler proposed a plan of allocating a large block of spectrum to the states for public safety purposes.[19] Although we realize that most regions are still implementing their plans, we seek comment on the extent to which these types of plans will satisfy the spectrum needs of the public safety community.

18. In the *1995 FCC Public Safety Report*, we concluded that more information from public safety agencies and other interested parties was necessary. We believe that our assessment of the current and future needs of public safety agencies, followed by our identification and implementation of the best means of meeting these needs, will ensure that the critical responsibilities of public safety agencies can be carried out more effectively and efficiently. Our goal in this proceeding is to foster a regulatory environment where agencies involved in the protection of life and property have the communications resources they need to carry out their mission and an opportunity to select from a wide range of advanced wireless communications services.

19. PSWAC, throughout its five subcommittees, is analyzing the communications

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[16] *See e.g., Report and Order*, Docket No. 21142, 43 Fed. Reg. 6779 (1978) (permitting use of digital voice modulation in the Police and Fire Radio Services and non-voice digital modulation in all private land mobile services); *Report and Order*, PR Docket No. 79-191, 85 FCC d 56 (1980) (allocating 50 "reserve pool" frequency pairs in the 800 MHz band for use by public safety licensees); *Second Report and Order*, PR Docket No. 79-191, 90 FCC 2d 1281 (1982) (allocating an additional 70 channels in the 800 MHz band, except in the Canadian and Mexican border areas, as public safety spectrum); *First Report and Order*, GEN Docket No. 81-413, [cite] (permitting use of spread spectrum and other wide-band technologies on certain frequencies in the Public Safety Radio Services); *Notice of Inquiry*, PR Docket No. 84-232, 49 Fed. Reg. 9754 (1984) (seeking comment on public safety spectrum needs); *Memorandum Opinion and Order*, GEN Docket 88-441, 4 FCC Rcd 3874 (1989) (determining it unnecessary to impose a uniform trunking standard for radio equipment manufactured for use on 800 MHz public safety frequencies); *Further Notice of Inquiry*, 4 FCC Rad 8519 (1989) (explores standards, technical, economic and regulatory issues that relate to advanced technologies in the Public Safety Radio Services).

[17] *See Report and Order*, GEN Docket No. 87-112, 3 FCC Rad 905 (1987).

[18] *See* GEN Docket No. 87-112, *Memorandum Opinion and Order*, 3 FCC Rcd 2113 (1988), for a description and list of the 55 regions. The National Plan provides a regulatory framework for 55 regional plans.

[19] *See* 142 CONG. REC. 34, S2000, S2002 (daily ed. March 13, 1996) (statement of Senator Pressler).

needs of public safety entities, the ability of emerging technologies to meet these needs, and ways to enhance the competitive opportunities in public safety agencies' procurement of equipment and services. PSWAC will develop specific recommendations for the Commission and NTIA and submit a report later this year. This *Notice* is a formal vehicle by which the Commission can receive PSWAC's report and general public comment on public safety wireless communications, and act upon PSWAC's recommendations. We believe that PSWAC's efforts play a crucial role in our efforts to accommodate the needs of public safety licensees in their implementation of state-of-the-art communications in furtherance of their mission of protecting life and property. In this connection, we anticipate that PSWAC's findings and conclusions will comprise a significant part of the record in this proceeding. We further expect that PSWAC's report, as well as all comments we receive, will establish a sufficient record for developing rules to facilitate a transition from the current state of public safety communications to an environment in which public safety agencies' communications are conducted in an effective and efficient manner, particularly through greater interoperability, access to emerging technologies, and greater use of commercial services where appropriate.

IV. DISCUSSION

20. As mentioned *supra*,[20] this *Notice* tracks the organizational structure of PSWAC. First, we address issues concerning interoperability, including proposed definitions for "public safety" and "interoperability" and how to facilitate the emergence of interoperability on a large scale within the public safety community. Second, we discuss the operational challenges associated with public safety wireless communications, including essential service features and system requirements. Third, we address how technology affects the quality, efficiency, and effectiveness of public safety wireless communications. Fourth, we discuss the options of allocating additional spectrum or reallocating spectrum in an effort to meet the current and future spectrum needs of the public safety community. Fifth, we discuss the transition to an environment in which the present deficiencies in public safety wireless communications (e.g. lack of interoperability, minimal access to emerging technologies, limited service feature options, less than optimal transmission and reception quality, and scarce available spectrum) are eliminated. Finally, we address the level of competition in the supply of goods and services in the public safety context and how to promote further competition.

A. Interoperability Issues

21. Given the current state of public safety communications, each agency most likely operates its own communications system on its own channels, using technologies that are incompatible with the equipment used by the other agencies. As an initial matter, we believe that an essential component of our efforts to improve public safety communications is to facilitate the development of communications links within public safety and public service

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[20] *See* ¶ 2.

wireless communications systems that permit units from two or more different agencies to exchange information with one another, which we generally refer to as "interoperability."[21] We also believe that it is crucial for these agencies to be able to exchange all types of information pertaining to their daily operations, in addition to information necessary for on-scene mutual aid operations and joint operations (such as basic voice, data, E911, images (including mugshots), fingerprints, video and other high speed data). We tentatively conclude that to the degree that public safety agencies operate on contiguous frequencies and use similar, or at least compatible, technologies, this ability to communicate is enhanced.

22. As discussed *supra*, state and local agencies operate systems in six different radio services on frequencies scattered throughout the VHF, UHF, and 800 MHz bands using various technologies which often are incompatible. Similarly, Federal agencies, licensed by NTIA, operate on non-contiguous frequencies scattered throughout the VHF and UHF bands. Consequently, local, regional, and national public safety agencies have little or not ability to communicate with each other. This inability to communicate hinders cooperation and coordination between public safety agencies on a day-to-day basis as well as during emergencies. We believe that the present inability of public safety agencies to communicate with each other is one of the most critical deficiencies in today's public safety communications.

1. "Public Safety" Definition[22]

23. We believe that our assessment of the current and future needs for public safety communications must begin with an evaluation of what services and agencies should be classified as "public safety." Under the Commission's current rules, the scope of PSRS is defined as a listing of services included within that classification.[23] Although the services included within the PSRS have eligibility requirements specific to these particular services, we recognize that our classification of certain types of service as PSRS and our decision not to include other services may indirectly affect the ability of public safety agencies to fulfill their missions. For example, numerous state and local governments have responsibilities, many of which depend on wireless communications, that do not involve the protection of life and property on a daily basis but nonetheless are vital functions on which the public depends.

24. In this connection, PSWAC is considering several proposals concerning whether

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[21] *See* discussion of the definition of interoperability, *supra*, at para. 26.

[22] We note, however, that the public safety definition that we ultimately adopt in this proceeding does not affect or alter the definition of "public safety facility" which we adopted for purposes of our mandatory relocation program in the 2 GHz band. *See* Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, *Third Report and Order and Memorandum Opinion and Order*, ET Docket No. 92-9, 8 FCC Rcd 6589 (1993), *aff'd, Memorandum Opinion and Order*, 9 FCC Rcd 1943, ¶¶ 34-46 (1994).

[23] 47 C.F.R. § 90.15.

"public safety" should be more strictly defined under the Commission's rules. The following definitions are being considered by PSWAC:

- *Public Safety*: The public's right, exercised through Federal, State, or local government as prescribed by law, to protect and preserve life, property, and natural resources and to serve the public welfare.

- *Public Safety Services:* Those services rendered by or through Federal, State, or local government entities in support of public safety duties.

- *Public Safety Services Provider*: Governmental and public entities or those non-governmental, private organizations which are properly authorized by the appropriate governmental authority whose primary mission is providing public safety services.

- *Public Safety Support Provider*: Governmental and public entities or those non-governmental, private organizations which provide essential public services that are properly authorized by the appropriate governmental authority whose mission is to support public safety services. This support may be provided either directly to the public or in support of public safety service providers.

- *Public Services*: Those services provided by non-public safety entities that furnish, maintain, and protect the nation's basic infrastructures which are required to promote the public's safety and welfare.[24]

25. We tentatively conclude that we should modify our approach of defining "public safety services" by a listing a services falling within that classification to a more precise definition of "public safety." Specifically, we propose to adopt PSWAC's definitions presented *supra*, in an effort to encompass the broadest array of the responsibilities and functions performed by public safety agencies. We seek comment on our tentative conclusion and proposal. We ask commenters to discuss whether these definitions are sufficiently broad to encompass all the functions and responsibilities of various public safety agencies. For instance, we note that the very nature of services such as utility, pipeline, petroleum and railroad often involve potential hazards where reliable radio communications is an essential tool in either avoiding the occurrence of such hazards or responding to emergency circumstances. Entities providing these services utilize radio communications not only in performing their routine functions but also in coordinating with local officials and other entities in maintaining or restoring these critical services. In addition, we seek comment on how the adoption of these definitions will impact both the provision of public safety communications and the development of new technologies for use by public safety licensees,

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[24] *See* Minutes of the Third Meeting of Interoperability Subcommittee of PSWAC, Dec. 14, 1995.

including the provision of public safety communications services by commercial entities.

2. "Interoperability" Definition

26. In order to promote the development of this communication capability, we must first define what is meant by interoperability. In this connection, the Interoperability Subcommittee of PSWAC is considering the following definition of interoperability and related definitions:[25]

- *Interoperability*: An essential communications link within public safety and public service wireless communications systems which permits units from two or more different agencies to interact with one another and to exchange information according to a prescribed method in order to achieve predictable results.

- The communications link may be classified as either of the following two types:

  - - *Infrastructure-independent*: The communications link occurs between subscriber units over a direct RF path. An example is portable-to-portable tactical communications at the scene of an incident.

  - - *Infrastructure-dependent*: The communications link requires use of some item(s) of equipment, other than a subscriber unit, for the establishment of the link and for complete subscriber operation. Some examples include a communications link for which a repeater station is required; a communications link which provides full system coverage for a visiting subscriber unit within a host trunked radio system; and a communications link which provides interconnectivity between two or more otherwise incompatible radio systems by cross-connecting the audio signals and/or appropriate signaling functions at some central point.

- The communications link, whether infrastructure dependent or independent, must satisfy one or both of the following requirements:

  - - *Multi-jurisdictional*: Wireless communications involving two or more similar agencies having different areas of responsibility. Some examples include a fire agency from one city communicating with a fire agency from another city and the Federal Bureau of Investigation communicating with a County Sheriff.

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[25] *See* Minutes of the Third Meeting of Interoperability Subcommittee of PSWAC, Dec. 14, 1995.

- - *Multi-disciplinary*: Wireless communications involving two or more different agencies. One example is a police agency communicating with an emergency medical services agency.

- The communications link may involve any combination of subscriber units and fixed equipment (*e.g.*, repeaters, dispatch positions, data resources). The points of communication are dependent upon the specific needs of the situation and any operational procedures and policies which might exist between the involved agencies.

27. We seek comment on the above definitions being considered by PSWAC and any proposals for different definitions. Specifically, we ask commenters to discuss whether these definitions will facilitate the expeditious development of interoperability for public safety agencies.

2. Interoperability Needs

28. We believe that the need for interoperability in public safety communications arises in three general contexts. One context is day-to-day operations. The day-to-day operations of public safety organizations require routine intercommunications capabilities. Police officers in adjoining jurisdictions as well as firefighters and emergency medical personnel in the same jurisdiction, for example, routinely need to exchange information. Typically, day-to-day interoperability requirements are local or regional in nature.

29. A second context is mutual aid incidents. We believe that on-scene mutual aid communications at the site of major fires, plane crashes, chemical spills, and other disasters represent one of the more challenging and critical needs for interoperability. In these situations, coordination among numerous public safety agencies from different jurisdictions, and sometimes even from different disciplines, is imperative. For example, on the site of a major plane crash, there could be representatives from law enforcement, fire, and emergency medical personnel from Federal, state and local jurisdictions. These various entities must communicate not only with each other but also with other agencies, such as highway maintenance, public works, public utilities and transportation authorities.

30. The third category is emergency preparedness events or task force operations. Emergency preparedness and task force operations involve joint operations of local, regional, state and Federal agencies. The number of public safety agencies involved in emergency preparedness is usually substantial because the agencies' responsibilities range from planning for disaster relief to coordinating tactical operations responding to threats to life or property. Task forces typically involve deployment of emergency operations centers, establishment of on-scene command posts, and dispatch of tactical units throughout a wide area. We believe that interoperable communications systems greatly enhance tactical operations among multi-jurisdictional and multi-discipline agencies participating on the task force.

31. We seek comment on these conclusions and on whether there are other contexts in public safety communications in which interoperability is needed. If so, we ask commenters to address the specific need for interoperability and the benefits received from development of interoperability in these other contexts.

3. Interoperability Options

32. We recognize that some public safety agencies already have made efforts to address the problems associated with multi-jurisdictional and multi-discipline interoperability. These initial efforts include provision of compatible radio equipment to units on-the-scene at an incident, use of dispatch centers through which messages are passed, and use of cellular telephones. In fact, several state and regional authorities have begun developing and deploying common user systems for public safety and public service agencies. These systems meet a range of operational requirements for a myriad of agencies and are premised on compatible equipment operating in 800 MHz and are essentially shared multi-site trunked systems. Some examples of these interoperability efforts are described below.

- The California counties of San Diego and Imperial have commenced a Regional Communications System (RCS) to replace the participating public safety and public service agencies' existing communications systems with a modern trunked system. When completed, the RCS, a trunked, simulcast, analog/digital 800 MHz radio system utilizing digital encryption for authorized users, will have more than 60 frequencies in use on separate voice and data radio infrastructures at more than 50 microwave repeater sites. Local agencies participating in the RCS development have pooled their radio frequencies. The RCS will include a separate voice backbone populated with a mixture of 25 kHz-spaced 806 MHz and 12.5 kHz frequencies, and a data backbone utilizing 25 kHz bandwidth, 19.2 bits per second, 9.6 baud capable 806 MHz channels. It is anticipated that the RCS will provide effective and reliable communications for routine intra-agency operations as well as interagency communications throughout the region during emergency and mutual aid operations. Public safety agencies (defined as law enforcement, fire service, emergency medical service, and disaster preparedness agencies) and public service agencies (defined as the California Department of Transportation, and those county agencies responsible for providing citizens with services other than law enforcement, fire and disaster preparedness) may join the RCS.[26]

- The State of Colorado has commenced a six-phase schedule for implementing a state-wide digital trunked radio system using the 800 MHz public safety bands. The implementation model assumes several types of users will seek to associate

[26] *See* San Diego County-Imperial County, Regional Communications System Agreement (March 7, 1995) and Request to the National Telecommunications and Information Administration submitted by the Department of the Navy and County of San Diego-County of Imperial (May 12, 1995).

themselves with the State network, while the State Patrol, Highway Maintenance, Natural Resources, and Corrections agencies will be full members. Rather than building their own radio systems, system members will contract with the state office responsible for the project and will likely pay a monthly service fee.[27]

- Other states, such as Nevada and South Carolina, are implementing state-wide systems in conjunction with power utility companies. These systems are designed to include interoperability capabilities with power utility companies in an effort to address a critical need currently unmet in disaster relief efforts.

We ask commenters to discuss the feasibility and effectiveness of these initial interoperability efforts.

33. We believe that there are additional means by which to satisfy the interoperability requirements of public safety agencies. We recognize that there are different advantages and challenges associated with each of these options. The following is a brief overview of the various options that we have identified to address interoperability concerns.

34. *Relocate all public safety communications to a new band.* A significant advantage associated with this option is that interoperability could be accomplished directly because all public safety radio equipment would operate in the same band. In fact, new common radios could be programmed to scan and operate on any channel in the band. We believe that this approach would necessitate a system of prioritizing access to the channels. In addition, certain channels could be designated exclusively for nationwide mutual aid use.

35. We note, however, that migration to a new public safety band would present several challenges. First, this approach would require a common interoperability standard for all public safety radio equipment. It is our understanding that the average life of existing public safety systems is approximately 15 years, with many agencies using their systems twice that long. If the purchase of new equipment compatible with the new band is tied to this cycle, interoperability would not be realized until the distant future. Second, additional public safety spectrum would be needed. We believe that identifying contiguous spectrum that is of the size and quality necessary and where incumbents can be relocated would be problematic. Despite these challenges, we nonetheless recognize that migration to a new band may present opportunities for commercial systems to offer solutions to the interoperability and capacity problems experienced by public safety licensees.

36. *Designate Universal Mutual Aid Channels.* We believe that access to designated universal mutual aid channels could be accomplished by using new multi-band radios or additional radio units. For example, a number of frequencies could be selected in one of the

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[27] National Telecommunications and Information Administration, Land Mobile Spectrum Planning Options, October 19, 1995 ("*NTIA October 1995 Report*") at A-7.

band segments between 30 and 800 MHz and designated for public safety communications. In addition, new public safety radio equipment could be required, through our type acceptance process, to operate on these designated frequencies. An advantage of this approach is that transition to universal mutual aid channels through employment of multi-band or separate dedicated radios would allow public safety agencies to continue operating existing systems while implementing interoperable equipment as older equipment is replaced. Moreover, inexpensive software programming could be used to modify much of the mobile and portable equipment currently employed by public safety agencies so that they could operate on the mutual aid channels. We believe that this approach also would require a common interoperability standard for all equipment operating on the mutual aid channels.

37. *Install Cross-Band Repeaters.* We recognize that installing fixed-base or mobile, multi-channel, cross-band repeaters is an approach which could address the interoperability needs of public safety agencies expeditiously. Traditional repeaters receive on one channel and retransmit voice or data on another channel. Under this approach, repeaters would be used to allow simultaneous communications on universally designated channels in each of the public safety bands. Moreover, gateways could be used as an alternative to cross-band repeaters.[28] Providing interoperability by this approach would require modification of existing dispatch facilities to interconnect the existing bands with universal mutual aid channels and, thus, investment in existing equipment. A disadvantage of this approach is that interoperability would occur only where the required fixed-base or mobile infrastructure is in place, thereby requiring jurisdictions to acquire such repeaters.

38. We seek comment on the various means of achieving interoperability in public safety communications. Specifically, we ask commenters to discuss the advantages and disadvantages of the approaches described above as well as any alternative means which we have not identified and provide any supporting data and information. We also ask commenters to address the amount of time required for implementation, what would be required for such implementation, and the effectiveness of each approach in solving the communications difficulties experienced by public safety agencies in day-to-day operations, mutual aid incidents, and emergency preparedness and task force operations. Commenters should include estimates of the costs associated with implementation as well as what entities should bear these costs and discussion of any regulatory and statutory requirements which operate to limit the flexibility or efficiency of public safety communications. Commenters also should discuss what solutions to public safety agencies' interoperability requirements can be provided by existing or planned commercial systems.

39. We tentatively conclude that establishing new universal mutual aid channels is an effective first step in providing for interoperability among Federal, state and local public safety agencies. We consider the ability of public safety agencies to continue operating their

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[28] A "gateway" is a conceptual or logical network station that interconnects two otherwise incompatible networks, network nodes, subnetworks or devices. It performs protocol conversion operations across a wide spectrum of communications functions or layers.

existing communications equipment while achieving interoperability to be a significant advantage as compared to the other approaches described *supra*. We seek comment on this tentative conclusion.

40. Assuming the designation of universal mutual aid channels, we tentatively conclude that 10 simplex and 10 repeater pair channels in a single band between 30 and 800 MHz should be designated for public safety agencies mutual aid communications nationwide. In this connection, we believe that channels selected from the existing public safety bands could employ the simplest, least costly, and easiest to implement technology. We request comments on our tentative conclusion and any alternatives. Are ten simplex and ten repeater channel pairs sufficient to meet the needs of Federal, state, and local public safety agencies? What specific channels are optimum candidates for designation as universal mutual aid channels? Should nationwide mutual aid channels be subject to a system of priorities? If so, what should the priorities be and how should the system be implemented? One system of priorities would be to designate Priority 1 for disaster mutual aid operations, Priority 2 for mutual aid operations involving imminent danger to the safety of life or property, Priority 3 for day-to-day mutual aid activities, and Priority 4 for single agency secondary communications.

41. To provide for interoperability between public safety agencies, we propose to adopt rules that require equipment for public safety use to have a common communications mode and frequency band. We seek comment on whether this approach has merit. If it does, should our rules specify the type of emission (*e.g.*, analog FM) that can be used in a specific circumstance or location, or should this decision be left up to the agencies responding to a particular incident? To meet the interoperable needs of public safety agencies, are there any specific emissions we should require to be included in public safety equipment? Should the type acceptance rules be amended to require equipment to cover more than one public safety frequency segment?

42. We also seek comment on whether the Commission should require all radios which are type accepted or sold for use on public safety frequencies to be capable of operating on the designated mutual aid channels. If so, what should be the effective date? We believe that multi-band radios or special dedicated mutual aid radios could satisfy this requirement. The amateur radio service community currently uses inexpensive multi-band radios to provide communications over two or more of the widely segmented amateur service bands. These radios generally are very feature rich. We ask commenters to discuss whether use of multi-band radios provides an expedient solution for addressing public safety interoperability requirements.

B. Operational Issues

43. Traditionally, public safety licensees have used a base station, repeater, and vehicular and handheld portable stations in conducting their two-way communications. Such communications have been conducted using both conventional and trunked operations. With

conventional voice and data systems, a single channel or a pair of channels[29] is used to communicate in a dispatch/supervisory mode or in a one-to-one mode with other users sometimes monitoring communications to determine whether additional action is needed. Since communications typically are of relatively short duration -- usually less than a minute -- channels often are shared by several independent users. Specific audio sub-audible tones may be used to permit any combination of mobile radios to receive the radio transmission. With trunked systems, several channel pairs are integrated into a single system[30] which automatically selects a currently unused channel pair and assigns it to the user desiring to transmit a message.

44. The VHF and UHF bands are used primarily for conventional, dispatch voice communications. The VHF high band frequencies and the UHF band have better noise and propagation properties than the VHF low band frequencies. Also, most public safety users prefer VHF high band and UHF band frequencies for their operations. The VHF-low band frequencies, which offer wide-area coverage, continues to be used extensively by certain public safety agencies, for example, state highway patrols. The 800 MHz band is used for both conventional and trunked systems. In the UHF and 800 MHz bands, channels are paired to permit use of repeater stations.[31]

45. Public safety agencies also use fixed services to provide radio communications between specified fixed points. These radio communications usually involve point-to-point systems operating in the microwave bands consisting of transmissions from a single fixed transmitting location to a single fixed receiving location. Some agencies also utilize a point-to-multipoint service in which multiple transmitting or receiving fixed stations are involved.[32]

46. Against this backdrop, we seek comment on the types of services that public safety agencies will need to accomplish their missions and the technical specifications required for implementation of such services. We believe that this information will allow us to gauge

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[29] *See* 47 C.F.R. § 90.7. A conventional radio system is a system in which a station is assigned to one or more radio frequency channels. The station may transmit only on its assigned channel(s), and only when it is not in use by another station.

[30] *See* 47 C.F.R. § 90.7. A trunked radio system is a system in which a station is assigned to a trunk group. A trunk group is a number of radio frequency channel pairs that are shared by all stations in the system. The station may transmit on any available channel in the trunk group. A trunked system is more efficient than a conventional system because more messages can be transmitted by the same number of stations within a given time.

[31] Signals from a control station or mobile unit are transmitted on one frequency and retransmitted by the repeater to another channel for reception by other control or mobile units. Repeater stations permit greater geographic coverage than otherwise possible. *See* 47 C.F.R. § 94.7. A repeater may be a mobile relay station or a mobile repeater station. A mobile relay station transmits on a base station frequency. A mobile repeater station transmits on a mobile station frequency.

[32] *See* 47 C.F.R. Part 94 for the rules governing fixed microwave services.

the needs of the public safety community and how these needs may change over the next 15 years. We further believe that such an understanding will improve planning for advanced requirements and new functional needs and allow needs to be prioritized more effectively, leading to a more efficient delivery of services to the public.

1. Service Features

47. Public safety spectrum is currently congested. There is no spectrum controlled by the Commission that is both available for allocation and adjacent to or quite close to existing PSRS frequency bands. Given this difficulty in allocating new spectrum for public safety services, we believe that it is crucial to consider what applications will be needed to carry out important public safety functions over the next 15 years. We are not persuaded that all of the communications needs identified by the public safety community can be met solely through the spectrum allocation process. Consequently, we believe that prioritizing needs is an essential step to ensuring that spectrum is allocated and services delivered in the most efficient and effective way possible.

48. Today, most radio communications by public safety agencies are conventional operations involving the transmission of voice and data. The demands on public safety communication systems, however, are expanding to include a host of high speed data applications such as fingerprints, photographs, building diagrams, slow and full motion video, and decisional data. We believe that public safety agencies should have access to the full range of available information services. We further believe that the following service features will be needed by various public safety agencies in the future in order for them to fulfill their missions:[33]

- *Enhanced Dispatch*: Basic one-to-many select group communications and one-to-one communications with enhanced features (*e.g.*, call set-up, priority interrupt, and interconnection with the Public Switched Network)

- *Transaction Processing*: Provision of short-duration, packetized alphanumeric data responses typical of current status-message systems (*e.g.*, pre-set encoded status entries indicating start/end route or minimal data entries)

- *Facsimile*: Wireless version of land-line service that provides text and black and white imagery

- *Snapshot*: Service with a higher resolution than facsimile that is capable of gray-scale or color imaging non-alphanumeric text and used primarily

[33] *See* Coalition of Private Users of Emerging Multimedia Technologies (COPE), *Petition for Rule Making*, Spectrum Allocations for Advanced Private Land Mobile Communications Services, filed December 23, 1993.

for the transmission of photographs (*e.g.*, mug shots and pictures of crime scenes or accidents)

- *Decision Support*: A high-speed data service that provides for interaction between mobile terminals and central data files enabling on-line decision-making by field personnel (*e.g.*, firefighting decisions where volatile chemicals are involved)

- *Full Motion Video*: Movie-type imaging (*e.g.*, full motion frame rates of at least 30 frames per second) that enables picture phone and color video of individuals or locations as communicated over the wireline system. Slow video provides high-resolution color images at modest frame rates (e.g, one frame per second) and could be provided real-time or on a store and forward basis (e.g., visual information of patient injuries sent directly to trauma specialists).

- *Linking/Roaming*: Similar to cellular offerings, services should be transparent to the user across a variety of wireless networks including PSTN, ISDN, and packet networks.

49. We seek comment on which, if any, of the public safety agencies will be interested in implementing the listed service features, and on what other service features are likely to be needed by public safety agencies. We ask commenters to discuss whether these features are widely used now. We also request comment on what demands the introduction of new service features will put on existing systems and infrastructures. How will these services be integrated into existing systems? Are additional allocations needed or can spectrum efficiency and sharing provide the needed capacity? Will new systems have to be built to accommodate them? To what extent can commercial providers meet demand?

50. In addition, we seek general comment on the specific service requirements, degree of use, and priority of the various classes of public safety services. Do these needs vary based on the type of geographic area (urban, suburban, or rural) served by the public safety licensees, and if so, how? How do the communications needs incident to the day-to-day operations of public safety licensees differ from those associated with unforeseen occurrences? What factors affect the level of differences?

2. System Requirements

51. We also seek comment on the performance requirements for the systems and equipment (including infrastructure hardware and software and mobile/portable terminals) used by public safety agencies for their radio communications. For example, for many public safety agencies, a critical element in their communications system designs is accommodation of the peak demand that occurs during multiple emergencies. Thus, these systems must have the capacity to handle not only routine traffic but also the increased level of traffic associated

with large-scale emergencies. We believe that speed, reliability, capacity, coverage, and range are key factors which contribute to the overall effectiveness of public safety communications. We ask commenters to discuss these system requirements as well as any other requirements necessary for effective and efficient operations by public safety agencies. We also ask commenters to discuss whether there are particular system requirements so critical that the Commission should require them for all public safety equipment. If so, what specifications, if any, for such equipment should be included in our rules?

52. We also note that for public safety agencies providing state and local government services, the continued expansion of traditional radio systems has resulted in spectrum crowding and hindered the deployment of many advanced service features. The design of systems with service features beyond voice will require network integration. By contrast, in many instances, public safety communications continue to be independently operated and based on analog FM radios. A major shortcoming of public safety radio systems that are independently operated is their inability to communicate with multiple entities; as a result, such systems are not capable of network integration. We recognize that there may be instances where single channel systems continue to be desirable because of equipment costs, abundance of channel availability, or low probability for multi-jurisdictional communications. In those instances, we believe that a group of channels may be designated for single-channel operations provided these channels are shared and licensees tolerate some level of interference.

53. We believe that economies of scale and improvement of effectiveness of public safety communications are two of the advantages associated with transitioning from independently operated single channel systems to joint networks. Another advantage of the use of networks, whether they are simple trunked systems or sophisticated satellites, is that they can establish "talk groups," which permit communication among a specific group of radios. The talk group process limits user interaction only to those set up by the network administrator. However, there are a number of options for rapid modification of talk groups. For example, some systems that allow over-the-air re-keying of radios could be linked together in a single new talk group during an emergency. Where multiple entities share the same system or network, communications during an emergency is routine.

54. In addition to talk groups, multiple site systems shared by several agencies could be a means of significantly increasing the amount of service available from a given number of channels. Increased construction and operational costs may be disadvantages associated with the implementation of multiple site systems because most public safety agencies have certain geographical areas where coverage is required and budget constraints limit implementation to only necessary services and provide for gradual upgrade of existing systems. On the other hand, a multi-site system with advanced service features could provide several agencies with additional services and user conveniences. Furthermore, cell-type architectures allow great flexibility in tailoring a system to meet traffic requirements of varying conditions ranging from urban, suburban, to rural. We note, however, that the greatest challenge with the use of multi-site systems shared by various agencies may be system administration. Various

administrative arrangements may be applied to mitigate the differing requirements among users. The benefits of enhanced communications services at reasonable costs makes multi-agency shared systems an important consideration in considering future system requirements.

55. We recognize, however, that no one communications package will meet all the needs of each public safety agency. In an effort to mitigate this problem, system gateways have been devised with limited success. We request comment on whether public safety licensees, as a general matter, should be required to utilize joint networks for their public safety communications. We ask commenters to address the advantages and disadvantages of independently operated systems and joint networks, both commercial and non-commercial, including how their use affects the delivery of services. We also ask commenters to discuss whether it is essential for public safety agencies to operate in the context of a larger system in order to increase feature availability, enhance interoperability, reduce initial capital costs, and maintain independent capability of public safety communications. We also ask commenters to identify those circumstances under which operation of individual systems would be more appropriate, and the role that system gateways could play in enhancing interoperability.

C. Technology Issues

56. We believe that a review of the technologies available to public safety licensees (both currently and prospectively) is imperative to accurately assess public safety communications needs and spectrum requirements. In this connection, we further believe that only through an understanding of available and emerging technologies and their impact on operational and spectrum requirements of public safety licensees can we move towards a regulatory environment which fosters effective and efficient public safety communications. Given atmosphere of the scarcity of spectrum, technologies must be analyzed to determine how public safety agencies' operational needs can be met in the most spectrally efficient manner. Moreover, these operational and technical requirements then determine the amount of spectrum needed as well as which frequency bands would best accommodate these requirements. Our goal in this proceeding, however, is not to dictate the technologies to be used by public safety licensees, but, consistent with our actions in the other Part 90 Private Land Mobile Radio Services, to provide an environment in which licensees have flexibility to choose from a range of technologies to support their respective operational requirements.

57. Over-the-air technologies have advanced rapidly over the past few years. As recently as ten years ago, mobile two-way equipment using analog Frequency Modulation (FM) in 25 kHz channels was considered state-of-the-art. Today, manufacturers are producing equipment to transmit at similar capacity levels but using only 5 kHz of bandwidth. Moreover, digital techniques allow four or more channels in a 25 kHz segment. Trunking technology permits hundreds of users to share a limited number of channels without interference. We envision that satellites may provide direct-to-mobile service in the not too distant future. We request comment, in general, on the impact of new technologies on the provision of new communications services and the demand for spectrum.

58. We note that there are at least four spectrally-efficient technologies currently available for voice and data transmission -- namely, Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Frequency Division Multiple Access (FDMA), and an assortment of narrowband technologies, including Amplitude Compandored Single Sideband (ACSSB). The Commission has neither endorsed nor selected any single standard based upon any one of these technologies. They, and many other technologies, are all currently available for use in the Public Safety Radio Services.

59. TDMA is a technology that increases the number of communications channels in a given spectrum segment by dividing each available channel into multiple time slots. The TDMA system being used by cellular licensees, for example, splits a 30 kilohertz 800 MHz channel into three time slots or channels while the TDMA system being implemented by wide-area Specialized Mobile Radio licensees splits a 25 kilohertz 800 MHz channel into six time slots. Furthermore, its digital nature offers a higher level of security than conventional analog radios.

60. CDMA employs spread spectrum modulation techniques and coding schemes to permit many separate communications to share a single wide-band communications channel. With CDMA each radio transmission is uniquely coded and spread over a bandwidth much wider than the minimum bandwidth necessary to transmit the traffic. The wider the bandwidth, the greater the advantages of CDMA in terms of increasing capacity and security and providing greater immunity to interference. This technology also offers the advantage of transmissions being difficult to intercept given its randomness and complexity. The CDMA system presently used by cellular licensees has the potential to provide an average of seven to ten times the capacity of existing analog systems.

61. FDMA assigns frequencies from a specific pool of frequencies to users either on a preassigned or an assigned demand basis. Current FDMA equipment offers a 2-to-1 efficiency gain over today's analog technology. Manufacturers, however, are hopeful that this efficiency can be increased to at least 4-to-1.

62. Narrowband equipment is currently being operated in the 150 and 220 MHz bands using ACSSB technology. Other narrowband technologies include Real Zero Single Sideband and Linear Modulation. It is anticipated that efficiency gains of up to five times more than that associated with 25 kHz analog FM can be realized using these technologies.

63. We seek comment on how use of the four technologies described *supra* would address the future spectrum and capacity needs of public safety agencies. We also ask commenters to address additional technologies that would improve the current state of public safety communications. We note that the Technology Subcommittee of the PSWAC is charged with responsibility for investigation of various technologies for public safety communications. We ask commenters to discuss the most efficient technologies available to meet the operational needs of public safety licensees, including specific determinations of how much efficiency can be gained through use of such technologies.

64. In addition to the specific technologies discussed *supra*, we believe that spectrum efficiency can be increased through greater sharing among users combined (including but not limited to sharing protocols) with strategic selection of antenna designs. For example, use of a 120-degree sectored antenna system, where phased antenna arrays are utilized for purposes of dividing the coverage area, would increase the system capacity of an individual system by a factor of three. In addition, such an approach would require construction of fewer towers.

65. Another alternative for sharing spectrum more efficiently is the effective use of trunking. We recognize that for many years certain private land mobile and cellular systems have used trunking to increase system capacity. We note, however, that the increase in spectrum efficiency depends upon the number of channels trunked and the blocking rate. For purposes of this analysis, we will assume that trunked systems have a 2.7 efficiency advantage over non-trunked analog channels. In addition, the trunking equipment available today permits users to prioritize calls, a feature which would further increase spectrum efficiency. We seek comment on whether strategic use of antenna designs and trunking as a means of increasing spectrum capacity is feasible for public safety operations. We ask commenters to discuss the extent to which these and other similar technologies currently are being used by public safety licensees. We also seek comment on the advantages and disadvantages associated with these uses.

66. The regulatory framework in which new technologies would be implemented also must be considered. One regulatory approach would be to require use of particular technologies by certain time periods. Another approach would be to codify no specific technologies; and, thus, leave the technology selection entirely to the users. We believe, as a general matter, that allowing maximum flexibility in licensee selection of equipment would be the best regulatory approach. We nonetheless recognize that mandating a specific technology may be necessary in order to promote an important regulatory goal, such as interoperability between public safety agencies. We seek comment on the degree to which our rules should specify particular technologies or capabilities. We also ask commenters to discuss what regulatory goal, if any, would warrant requiring use of particular technologies.

67. Assuming that use of particular technologies is not mandated, we seek comment on how our rules should be crafted to permit operational flexibility while ensuring that particular elements, such as interoperability, are present. We ask commenters to discuss alternative regulatory approaches, including the operational factors (such as locality, population or unique geographic features) which should be considered in the regulatory approach we adopt. One alternative would be to specify technologies for each authorized channel or bandwidth. Another alternative would be to specify channel bandwidth and efficiency standards and permit use of any technology satisfying such standards. An advantage of this approach is that it allows a significant amount of flexibility in the selection of technologies and spectrum used to fulfill specific operational needs. In this connection, should we rely on the expertise of certified frequency coordinators for tailoring specific technologies to the needs of public safety agencies and the communities which they serve? We ask commenters to discuss the amount of discretion and responsibility afforded to

frequency coordinators in this context. We also seek comment on other means of providing public safety agencies with the optimal amount of operational flexibility.

68. In addition, we ask commenters to discuss whether the Commission should specify technical standards for both receivers and transmitters. Traditionally, the Commission has chosen only to specify emission standards for transmitters on the premise that transmitters with excessive emissions could interfere with other users of the spectrum. As a result, licensees have had total discretion regarding the quality of the receivers they use. NTIA notes that interference is actually a function of transmitter and receiver performance and that spectrum efficiency is enhanced whenever both are optimized. NTIA suggests that adoption of receiver standards would facilitate sharing between users and enhance performance. NTIA also states that the homogeneity of systems practices within frequency bands not only would be desirable but also would enhance the sharing potential.[34] We seek comment on whether receiver standards or overall system performance standards should be adopted. Specifically, we ask commenters to discuss the advantages and disadvantages of adopting such standards. In addition, assuming these standards are adopted, we ask commenters to address what specific standards would be appropriate and why.

D. Spectrum Allocation

1. Overview of Spectrum Issues

69. Due to historical, regulatory, and technological forces, the spectrum now allocated to PSRS is highly fragmented. Consequently, public safety licensees have experienced severe interoperability problems, especially in connection with their operations during emergencies and disasters. This fragmentation of spectrum also has resulted in inefficient use of public safety spectrum and public safety communications systems that are costly and cumbersome. Against this backdrop, we request comment on ways to make more effective use of the spectrum allocated to public safety services, as well as the spectrum necessary to ensure that the current and future needs of the community are met in a timely and cost-efficient manner.

70. In determining spectrum requirements, several factors must be considered. The service needs and technological developments are discussed *supra*. We also have noted that the amount and location of the required spectrum is directly related to the information transmitted, the rate of transmission, the equipment utilized, the distances involved, and the quality and dependability needed. Additional information imposed on a radio signal increases the bandwidth of the channel occupied by the transmitted signal.[35] For example, one video

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[34] NTIA, U. S. Department of Commerce, NTIA Special Publication 94-31, "U.S. National Spectrum Requirements: Projections and Trends," March 1995, at 179 (*NTIA March 1995 Report*).

[35] Bandwidth is that portion of the radio spectrum that is between the upper and lower limits of the channel.